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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/870,412	05/30/2001	Lawrence G. Clawson	1955 P 066	7092

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EXAMINER

MERCADO, JULIAN A

ART UNIT	PAPER NUMBER
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1745

DATE MAILED: 01/23/2004

13

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/870,412

Applicant(s)

<Unknown>

Examiner

Julian Mercado

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 9-8-03, 10-3-03.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-80 is/are pending in the application.
- 4a) Of the above claim(s) 66-80 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-65 is/are rejected.
- 7) ☒ Claim(s) 41-43, 58, 59 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4, 12
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

Election/Restrictions

Applicant's election of Group I encompassing claims 1-65 in Paper No. 10 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Accordingly, claims 66-80 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-65 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The examiner notes that a preliminary amendment has been entered for independent claims 1, 18, 25, 28 and 45 which introduces the limitation that the mechanical energy from the expander is "in excess of the energy used in compressing the pressurized air" (or similar

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language thereto). This limitation raises the issue of the fuel cell system seemingly in violation of the fundamental law of conservation of energy. While it appears to the examiner that applicant is claiming the conversion of the thermal energy used to compress the pressurized air (via evaporation of the cooling water) into mechanical energy, the total energy within the domain must remain constant.

A fair reading of applicant's disclosure appears to suggest that applicant actually intends to claim a near-total efficient fuel cell system in conversion of heat to mechanical energy, the examiner notes applicant's specification on page 17 line 19-21, where it is disclosed that "all of the heat added to drive the expander is recovered" and that "the expander is effectively 100% efficient".

Claim 38 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for reacting the air/steam mixture in a burner to produce a steam-containing exhaust, does not reasonably provide enablement for preheating the air/steam mixture "before reacting the air/steam mixture". The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. The scope of dependent claim 38 requires the steam-containing exhaust to be produced before the air/steam mixture is heat-exchanged with said steam-containing exhaust.

Claim 39 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for using some of the air/steam mixture as a humidified oxidant of a fuel cell, does not reasonably provide enablement for using the air/steam mixture "before evaporating water into pressurized air". The specification does not enable any person skilled in the art to

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which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. The scope of dependent claim 39 requires evaporating of the water using waste heat from the fuel cell, thereby requiring the fuel cell to be operational for the resultant waste heat to be produced.

Claims 2-17, 19-24, 26, 27, 29-44 and 46-65 are rejected under 35 U.S.C. 112, first paragraph, as being dependent upon a rejected base claim.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1-17 recites the limitation "compressing the pressurized air" in line 11. There is insufficient antecedent basis for the limitation "the pressurized air" in the claim. As the claim recites "pressurized air" in both line 3 and line 6, it is unclear as to which instance of pressurized air is to serve as the antecedent for that referred to in line 11 of claim 1. It appears to the examiner that applicant intends to refer to the second instance of pressurized air as recited in line 6, and this intent would be more clear if the claimed "the pressurized air" is more properly recited as a "pressurized air/steam mixture". See, for example, claim 28 which recites that the pressurized air is created into a pressurized air/steam mixture. Additionally, there is insufficient antecedent basis for "compressing" of the pressurized air or air/steam mixture. It appears to the

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examiner that this portion of the limitation is in reference to “to make a pressurized air/steam mixture”, i.e. to make a pressurized air/steam mixture results in compression of pressurized air.

Claims 2-17 are rejected under 35 U.S.C. 112, second paragraph as being dependent upon a rejected base claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 25, 26, 28-35, 39, 40 and 42 are rejected under 35 U.S.C. 102(b) as being anticipated by Chludzinski et al. (U.S. Pat. 4,473,622).

Regarding independent claims 25 and 28, Chludzinski et al. teaches a fuel cell system comprising the steps of providing pressurized air via the compressor portion of a compressor-expander [27]. (col. 4 line 39-47) Heat from a fuel cell is used to make an air/steam mixture, “[t]he reaction air is then humidified by absorbing water from the exhaust via water transport membranes in the exhaust air economizer [31]”. (col. 4 line 48-50) The cooling water from the fuel cell cooling system contained in its exhaust air is evaporated, “[t]he reaction air is then humidified by absorbing *water from the exhaust* via water transport membranes in the exhaust air economizer [31]”. (*ib*, emphasis added) The air/steam mixture is heated by fuel burner, i.e. CO shift reactor [24], exothermic by nature, which generates steam from the reaction to drive the compressor-expander [27], “the remaining steam which is generated by the exothermic reaction

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in CO shift reactor 24 is fed to the free piston compressor and compressor expander in section 4 to compress the reaction air". (col. 5 line 20-23, see Figure 1 which illustrates the resistive heating element) The exhaust is also a heat source for fuel reformer [17] via heating chamber [19]. (col. 3 line 32-38, applies to dependent claim 29) The fuel reformer is of the methanol steam reforming type. (applies to dependent claims 30, 31) The examiner notes that it would naturally flow for one of the reactions in the CO shift reactor, referred to by the patentees as a "water shift" to proceed as follows: $\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$. As shown in the reaction, this step reduces or consumes carbon monoxide by the water gas shift reaction also known as steam reformation. (applies to dependent claim 26, 32-35) The air/stream mixture is combusted with a fuel such as the hydrogen reformat. (col. 3 line 54-67, applies to lines 8-9 of independent claim 45) With respect to dependent claim 42, conduit [33] forms part of the path from the fuel cell leading to burner [24] wherein water at the selected point [34] is removed from the air/steam mixture, "[t]his exhaust air is then fed via conduit 33 to a liquid vapor separator 34 where the liquid water is separated from the exhaust air". (col. 4 line 67 et seq.) bed". (col. 3 line 32-34)

To the extent that the scope of the present claims are understood enabled for the reasons discussed under 35 U.S.C. 112, first paragraph (discussion above), as to recovering mechanical energy from the expander in excess of the energy used in compressing the pressurized air, in Chludzinski et al. the energy from the expander portion of the compressor-expander would requisitely be in excess of the energy used in compressing the pressurized air via the compressor portion thereof since energy transfer would naturally follow the second law of thermodynamics, i.e. 100% conversion of heat into mechanical work is not possible and therefore an excess of energy from the expander is required for system operation.

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To the extent that dependent claim 39 is believed to be enabled for the reasons discussed under 35 U.S.C. 112, first paragraph (discussion above), the air/steam mixture, i.e. humidified oxidant is returned to the fuel cell via conduit [32], whereby the air/steam mixture is fed directly to the cathode portion of the fuel cell as an oxidant. (col. 4 line 56-60) Regarding dependent claim 40, additional water is added to the air/steam mixture via condensed water from cell membranes containing product water. (col. 4 line 60-65)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 36 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chludzinski et al as applied to claims 25, 26, 28-35, 39, 40 and 42 above.

The teachings of Chludzinski et al. are discussed above.

Regarding dependent claims 36 and 37, as discussed above the exhaust is also a heat source for fuel reformer [17] via heating chamber [19]. (*ib*) While Chludzinski et al. does not explicitly teach or at least suggest heating of the reformer before or after driving the expander, both of these configurations would naturally occur during the start-up and fully operational modes of system operation, respectively. (col. 3 line 32 et seq.)

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Claims 27, 38 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chludzinski et al. as applied to claims 25, 26, 28-35, 39, 40 and 42 above, in view of Bloomfield (3,976,507).

The teachings of Chludzinski et al. are discussed above.

To the extent that dependent claim 38 is believed to be enabled for the reasons discussed under 35 U.S.C. 112, first paragraph (discussion above), while Chludzinski et al. does not explicitly teach preheating the air/steam mixture, Bloomfield teaches preheating of the gases that enter turbine [42]. Thus, the skilled artisan would find obvious to preheat the air/steam mixture in Chludzinski et al.'s invention in accordance with the patentees feeding of the air/steam mixture to the compressor-expander, for reasons such as driving the compressor at a speed sufficient to maintain a desired output pressure. (see Bloomfield, col. 4 line 57 et seq.)

As to dependent claims 27 and 44, while Chludzinski et al. does not explicitly teach the expander to be a turbine, Bloomfield is relied upon to specifically demonstrate mutual equivalence of an expander to a turbine in that a turbine matches the function, way of operation and result of an expander, and additionally a turbine for an expander would be an obvious substitution to the skilled artisan in recognition of a turbine's capability of providing sufficient mass flow rates required by a fuel cell stack. (see Bloomfield, col. 5 line 37-59)

Allowable Subject Matter

Claims 41-43, 58 and 59 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims and if rewritten to overcome the rejection(s) under 35

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U.S.C. 112, first paragraph, set forth in this Office action. To the extent that dependent claims 41-43 are believed to be enabled for the reasons discussed under 35 U.S.C. 112, first paragraph (discussion above), Chludzinski et al. does not teach or at least suggest water to be added after the mixture has emerged from the fuel cell, though water is added "within" the fuel cell as a consequence of product water formation. (col. 4 line 60-67)

To the extent that dependent claims 58 and 59 are believed to be enabled for the reasons discussed above, Chludzinski et al. teaches away from this configuration in that the fuel burner [24] (as relied upon in this Office action) is notably exothermic in nature, thus preheating of its input feeds is not taught or suggested. Additionally, it is suggested to change "the heat exchanger" to --a heat exchanger-- as the former recitation lacks antecedent basis.

Claims 1-24, 45-57 and 60-65 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, first paragraph, set forth in this Office action. To the extent that claims 1-24, 45-57 and 60-65 are believed to be enabled for the reasons discussed above, the prior art of record and to the examiner's knowledge do not teach or render obvious at least to the skilled artisan the instant invention regarding introducing an air/steam mixture as an oxidant or combusting of said mixture with a fuel in a fuel burner

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Grot et al. (U.S. Pat. 6,001,499) is cited to teach that a water gas shift reformation step is insufficient in reducing the amount of CO in the reformat, thus, a preferential oxidation of carbon monoxide step is necessary. (col. 2 line 30-47)

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The documents cited in lines AR-AS in the IDS filed October 3, 2003 (Paper No. 12) have not been considered as copies thereof are absent from the file. Applicant is kindly requested to provide copies thereof for these references to be considered by the examiner in the next Office communication.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Julian Mercado whose telephone number is (571) 272-1289. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

A handwritten signature, possibly reading "Jam", is written in black ink.

Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700